TO ANALYZE THE PARAMETERS FOR JOINING OF HIGH DENSITY POLYETHYLENE PIPES MATERIAL

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Abstract: The production industries are always concerned about the cost and quality of the product they are manufacturing. When the product is related with agriculture (farmers), then the cost factor becomes more important. This work is a step towards the reduction of the cost of joining of HDPE pipe so reducing the overall cost. This can be done by comparing the different methods of joining these pipes. This work will be focused on the reduction of cost by considering the three factors, material of the HDPE pipe, time of weld of the two pieces and the cost of machines and the joining cost. Here we are interested in finding a viable method of joining to reduce the time and thus the cost.

Keywords: HDPE, LD, HD, Hot plate

I. INTRODUCTION:

HDPE pipes are made of polyethylene, a material that gives the pipe a few properties considered as advantages over other pipe materials such as concrete and steel. Due to the use of polyethylene, HDPE pipes are lighter than other pipes; this results in faster and less costly installation. HDPE pipes are very flexible compared to other pipe materials, an HDPE pipe would deflect up to 30% of its original diameter without any imperfection or structural failure[1,2]. Using HDPE pipes helps significantly in cost savings in manufacturing, installation and maintenance of the pipes. An HDPE pipe has fully restrained joints that make the pipe leak proof. In addition to that, these joints along with the smoothness of the inner surface of HDPE pipes result in a minimal resistance to flow, so the flow remains relatively constant during the lifetime of the pipe. The solid-wall high density polyethylene pipes are widely used for agriculture applications in the field of irrigation, drainage and water supply [3]. HDPE pipes are selected over other conventional pipes as they are the least expensive option when comparing pipe materials , installation costs, and performance [4-6]

II. METHODS OF JOINING

1. Hot plate joining
2. Spin joining
3. Electro fusion joining

III. PREPARATION OF SPECIMENS

Total 15 specimens are prepared as shown in table no 1.

Table No. 1: Preparation of Specimens

Specimen No.	**% of LD**	**Joining Method**
1	4	Hot plate joining
2	6	Hot plate joining
3	8	Hot plate joining

4	10	Hot plate joining
5	12	Hot plate joining
6	4	Spin joining
7	6	Spin joining
8	8	Spin joining
9	10	Spin joining
10	12	Spin joining
11	4	Electro fusion joining
12	6	Electro fusion joining
13	8	Electro fusion joining
14	10	Electro fusion joining
15	12	Electro fusion joining

IV CALCULATION OF TIME OF JOINING

The total time of welding includes various time parameters which are different for different methods of joining. [7-8]

1 Fusion joining

In fusion welding first the temperature of the two parent parts is increased up to the molten stage. Then the two pieces are hold together for some time which is called the hold time. Then the joint is allowed to cool for some time to make the weld. So to calculate the total time of joining in fusion joining we consider the following-

a. Heating time

b. Hold time

c. Cooling time

2 **Spin joining**

In spin or friction welding first the pipe piece is hold in the jaw and the other piece is matched with the first piece. Then the machine spins that part to make the weld. So the total time of joining the following-

a. Preparation time

b. Spinning time

3 Electro fusion joining

Inelectro fusion joining first the pipe pieces are matched and hold together in the coupler. Then they are heated for some time. Finally it is allowed to cool to make the weld. The total time of joining includes-

a. Preparation time

b. Heating time

c. Cooling time

V. FUSION JOINING

The three time parameters are noted for the five specimens as under-

Table No. 2: Time in second

Sr. No.	Heating time	hold time	cooling time
1	170	40	960
2	155	40	940
3	150	40	940
4	148	40	925
5	140	40	890

VI. SPIN JOINING

The two time parameters are noted for the five samples as under-

Table No 3: Time in Second

Sr. No.	Preparation time	Spinning time
1	170	38
2	170	38
3	170	35
4	170	33
5	170	32

VII. ELECTRO FUSION JOINING

The three time parameters are noted for the five specimens as under-

Table No. 4: Time in Second

Sr. No.	Preparation time	Heating time	cooling time
1	215	190	750
2	215	185	735
3	215	185	730
4	215	170	715

5	215	165	710

IX. COST CALCULATION

The total cost of joining for hot plate welding includes the initial cost and processing cost. The cost of machine and the cost of Teflon are covered in the initial cost while the heating cost comes under processing cost. So the various costs related with hot plate welding are cost of machine, cost of teflon cloth and heating Cost.

Table No.5: Cost Calculation in INR for Fusion Weld

Sr. No.	**Fusion Weld**
1 cost of m/c	20000(apr.)
2 cost of T.cloth	280/100pc.
3 cost of pads	-
4 heating cost	0.60
5 spinning cost	-

Table No.6: Cost Calculation in INR for Spin Weld

Sr. No.	**Spin Weld**
1 cost of m/c	25000(apr.)
2 cost of T.cloth	-
3 cost of pads	190/300pc.
4 heating cost	-
5 spinning cost	0.25

Table No.7: Cost Calculation in INR for Electro Fusion Weld

Sr. No.	**Electro fusion Weld**
1 cost of m/c	45000(apr.)
2 cost of T.cloth	-
3 cost of pads	-
4 heating cost	0.70
5 spinning cost	-
6 cost of coupler	4500/4000pc.

X. CONCLUSION

After analysis the three joining methods it was found that the electro fusion joining is applicable only for few applications. The pipe fitting like coupler, tail, band, reducer ete.are very difficult to join by electro fusion welding. So it is applicable only for the joining of two pipe pieces. Material:- The quality of raw material also affects the joining process. It is observed that the percentage of L.D. should be selected very carefully. L.D. percentage of less than four percent and more than twelve percent does not give good results. It is also observed that the ten percent L.D. is preferred for HDPE sprinkler pipes as well as HDPE buried pipes.

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